Neutron TOF and ion beam irradiation apparatus in ten's of MeV region at Tohoku University cyclotron laboratory

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Data on neutron production and radio nuclide-production are of prime importance for accelerator application and the space technology.

In the Cyclotron and Radioisotope Center, Tohoku University (CYRIC), equipped are an AVF cyclotron (K=110 MeV) and 1) a neutron TOF system employing a beam swinger and a well-collimated neuron flight path up to 44 m, and 2) an automated irradiation/ sample changing mechanism. For 1), a beam chopper to reduce the beam frequency to 1/10 is also available to enable TOF measurements down to < 1 MeV.

The beam swinger TOF system enables measurement of angular distributions without changing the detector arrangement from 0-deg. to 145-deg (now up to 110-deg). A bending magnet is employed to sweep out the beam which have transmitted the target into a beam dump. Therefore, measurement at 0-deg is possible for thin targets. Using the system, measurements have been done on energy-angular differential thick targets neutron yields for (p,n) and (d,n) reactions, and neutron emission cross section for thin targets at ten's of MeV region. Experiment will be extended to thin targets of major elements.

The irradiation system consists of irradiation chamber, cooling system, sample transporter and a beam collimator. Samples are kept in the chamber and set on the transporter outside the room. It is transported to the target position and set at irradiation position, irradiated and returned according to the program. This is used for activation cross sections and/or radionuclide production by the ion beam bombardment. By applying the stacked target technique, excitation functions are being obtained for proton and deuterons. Activation by neutrons are also in progress using quasi-monoenergetic neutrons produced by the ^{7}Li(p,n) reactions.

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